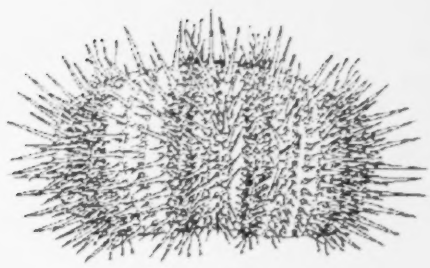
Fisheries and Oceans Canada
Science
Maritimes Region

Pêches et Océans Canada
Sciences

Canadian Science Advisory Secretariat
Science Advisory Report 2010/002

ASSESSMENT OF THE BAY OF FUNDY SEA URCHIN FISHERY, LOBSTER FISHING AREA 38



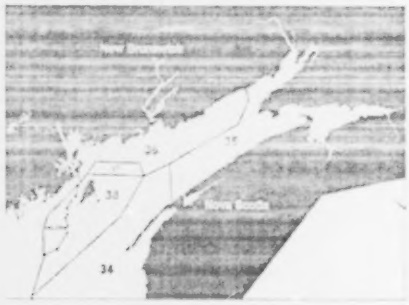


Figure 1: Bay of Fundy Lobster Fishing Areas.

Context:

A green sea urchin (Strongylocentrotus droebachiensis) fishery along the coast of southwestern New Brunswick, in the Bay of Fundy, operated at a small scale in the 1950s, 1960s, and the early 1980s. The commercial industry did not actually develop until 1989. The sea urchin fishery in southwestern New Brunswick was separated into two management areas. These two areas were assigned the same boundaries as Lobster Fishing Areas (LFA) 36 and 38 (Figure 1). In LFA 38, the existing sea urchin fishery is based on a total allowable catch (TAC) system and under non transferable individual boat quota. The urchins are harvested by dragging. It is currently managed using a minimum legal size limit of 51 mm test diameter (TD), and by a fishing season. The majority of the catch is taken from shallow water coastal areas less than 10 m.

Management and urchin fishers were concerned about the decline in landings over the last eight years and the lack of up to date information on the status of the sea urchin stock. In order to address this lack of information, diver-based sea urchin surveys were initiated during the summer of 2005, 2006 and 2007. The objective was to resurvey the traditional urchin fishing grounds off Grand Manan Island and update the information on the status of the urchin resource.

The LFA 38 sea urchin fishery is currently managed by Fisheries and Oceans Canada (DFO). A Conservation & Harvesting Plan (CHP) was developed in consultation with all the license holders in the fishery. These management measures are reviewed on an annual basis with members of the sea urchin industry. The last peer-reviewed stock assessment of this resource was completed in 2000 using data from the 1992 survey.

SUMMARY

- There had been a consistent decrease in the catch per unit of effort (CPUE) for the drag fisheries since 1996-97, until it reached its lowest level in the 2006-07 fishing season. During the 2007-08 fishing season, catch rates increased for the first time since 1996.
- CPUE has elements of population abundance but is influenced by discarding due to product quality and market prices. Therefore, the CPUE series must be interpreted with caution and cannot be used exclusively as an indicator of population abundance.

February 2010

Canada

- The number of fishing trips has declined to a low of 179 trips during the 2007-08 fishing season.
- The total allowable catch (TAC) of 979 t that was established in 1996 was voluntarily reduced to 778 t in 2000-01, to 590 t in 2004-05 and to 176.9 t in 2006-07.
- Total biomass has changed little between the 2005 and 1992 survey periods. While estimated fishable biomass has declined, there is no statistically significant difference between the two surveys due to a high degree of variability.
- Within all the fishing locations combined, the density of legal sized sea urchin showed no significant differences between the 2005 and 1992 survey periods. However, based on a subset of transects conducted in all years, the density of legal sized urchins was significantly lower in 2006 (1.9 urchins/m^2) and 2007 (3.0 urchins/m^2) compared to 1992 (6.5 urchins/m^2).
- Based on the established TAC of 176.9 t, the recent exploitation rates are estimated to be 1.5%, which is lower than the harvesting rate of 3.3% in 1996.
- The implementation of the new logbook format will facilitate collection and analysis of effort and harvesting rate data by fishing area in more detail and on a timelier basis.
- Limited at-sea observer sampling showed that the by-catch amount varies between fishing areas but was consistent in the species type present. Most of the by-catch consisted of kelp and blue mussels. In general, by-catch was low.
- Fishery impacts on the ecosystem with respect to by-catch of non-urchin species and potential impact of urchin fishing on the habitat requires collection and processing of new information.
- The recommended assessment schedule is every 5 years. However, annual monitoring of the landings, fishing effort, and catch rate from the fishing logs would be useful to determine if an earlier than scheduled assessment is required.

BACKGROUND

Species Biology

The green sea urchin, *Strongylocentrotus droebachiensis*, is an echinoderm that is distributed in the Atlantic Ocean from New Jersey to the Arctic, extending south to Britain. It is also distributed in the Pacific Ocean from Washington to Alaska. The animals are omnivorous in nature, although they feed primarily on seaweeds. Sea urchins are most plentiful in shallow waters less than 10 m deep, although they may be found down to 1,200 m. Urchins can be found on virtually any type of substrate, but they generally prefer harder surfaces. The animals have separate sexes, mature at approximately 25 mm test diameter (TD) and spawn in late winter/early spring. The resulting planktonic larvae settle in 8 to 12 weeks. Growth can be quite variable, and is dependent on food supply and environmental conditions. The time estimated to reach commercial size (51 mm TD) may take from 3 to 15 years. Currently there are no estimates of natural mortality available. There is no evidence of mortality due to the infectious disease caused by *Paramoeba invadens* in the Bay of Fundy, as has been experienced in the past along the Atlantic coast of Nova Scotia.

Rationale for Assessment

The sea urchin fishery exploitation rate is currently based on a percentage of fishable biomass (3.3%, implemented in 1996) that was estimated using survey data from 1992. The last peer-reviewed advice on biomass for LFA 38 was completed in 2000. In 2007, a DFO Science Response Report to Fisheries and Aquaculture Management Branch recommended the lowered 2006/07 total allowable catch (TAC) be maintained in the LFA 38 urchin fishery until a more

rigorous assessment was done (DFO 2008). Updated peer-reviewed advice on the fishable biomass is required, including results of resource surveys from 2005, 2006, and 2007.

The Fishery

The LFA 38 sea urchin fishery is currently managed by Fisheries and Oceans Canada (DFO). A Conservation and Harvesting Plan (CHP) was developed in consultation with all the license holders in the fishery. At the present time, 8 of the thirteen licenses are issued to 3 different First Nations as commercial communal licenses. The remaining 5 licenses are issued to independent core fish harvesters and are subject to the owner-operator policies. The CHP includes; a minimum size limit (TD of 51 mm (2.0 in.), sea urchins to be sorted and culled at sea, harvesting between sunrise and sunset, mandatory submission of logbooks, and 100% dockside monitoring of landings. During 2007-08, the fishing season extended from the second Monday of December to March 14, or until the license holder's initial individual quota of 13.6 t (30,000 lbs) round weight has been caught, whichever comes first. At the inception of the commercial LFA 38 sea urchin fishery in the early 1990s, this fishery was limited entry. Presently, there are 13 licensed dragging operators with the option of converting (not permanently) to dive licenses if requested by the fishermen.

Dragging operations are required to use urchin drags with a maximum opening width of 1.8 m (6 feet). The diver-based fishing consists of a maximum of four divers in the water and two skiffs with a maximum length of 7.3 meters (24 feet) each. The skiffs may be used within 457 m (1,500 ft) of the mother boat to tend the divers.

The fleet operates under a TAC of 176.9 t. The fleet TAC is divided amongst the 13 licenses to provide an equal Individual Quota (IQ) to each license. IQs are non-transferable. As the commercial communal licenses must designate an individual to fish the IQ on behalf of the First Nation, there is, however, some potential for transfer of benefits associated with an IQ.

These management measures are reviewed on an annual basis with Grand Manan Urchins Inc., the license holder association, and other industry stakeholders.

Figure 2 shows the commercial landings for this fishery since 1989-90. A TAC of 979 t was set in 1996. Since then, the TAC has been voluntarily reduced three times by the industry. The original TAC was reduced to 778 t during the 2000-01 fishing season, to 590 t during the 2004-05 fishing season, and to 176.9 t in 2006-07. During the 2006-07 fishing season, an additional TAC of 176.9 t was allocated to an urchin fishing area situated on the back side of Grand Manan called Zone 2. Zone 2 was originally part of Zone 1 where the traditional fishing occurs. Very little fishing occurs in Zone 2 because of difficult access, long distances from home port and lower catch rate. Fishing in Zone 2, is only allowed after individual quota on the traditional fishing ground (Zone 1) has been caught. During the last two seasons, the limited urchin landings from Zone 2 all came from diving activity.

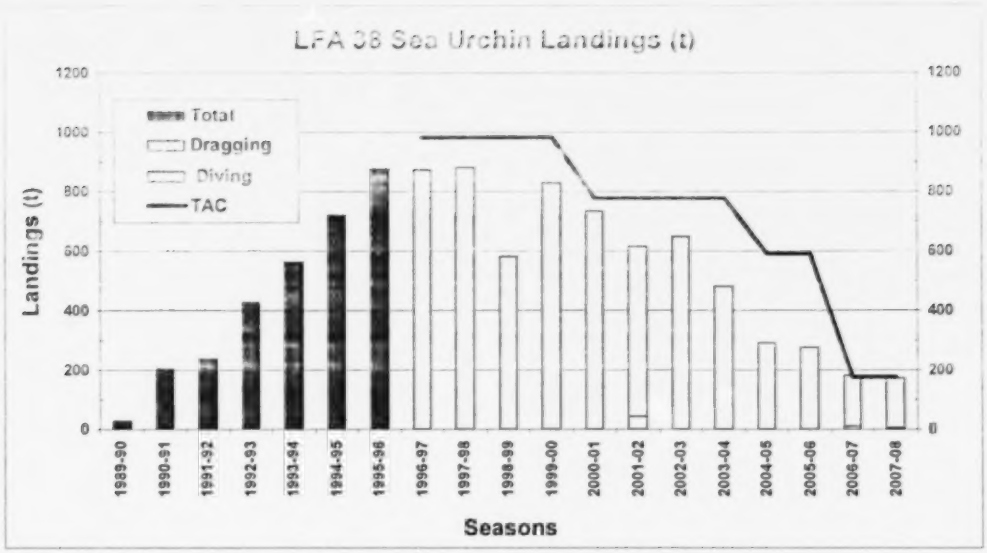


Figure 2: Historical sea urchin landings and TAC in metric tonnes (t) for LFA 38.

Landings trends in LFA 38 are analyzed using logbook information. During fall 2008, a new type of logbook was introduced that reported the location of fishing by previously defined fishing areas. However, data from the new logbook were not yet available in time to be analyzed for this report. Logbook data are used to calculate effort trends and catch per unit of effort (CPUE) indices for individuals, groups and locations. Catch rate and effort trends based on the analysis of logbook information is presented as the average kilogram of urchin landed per fishing trip (Kg/Trip), and the total number of fishing trips during each fishing season (Table 1).

Table 1. Landings in metric tonnes (t), the TAC (t), *catch rates in kilograms per trip (Kg/Trip) and effort in number of trips per season in LFA 38 from the 1996-97 to 2007-08 fishing seasons.*

Seasons	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08
Landings (t)	872	883	581	830	734	574	650	480	289	277	174	165
TAC	979	979	979	979	778	778	778	778	590	590	177	177
Kg/Trips	1359	1218	1072	1072	991	995	988	875	865	862	744	922
# of Trips	641	725	540	773	739	576	657	547	333	320	233	179

CPUE has elements of population abundance but is influenced by discarding due to product quality and market prices. Therefore, the CPUE series must be interpreted with caution and cannot be used exclusively as an indicator of population abundance.

There has been a consistent decrease in CPUE since 1996-97 (Figure 3). During the 2007-08 fishing season, catch rates increased for the first time in a decade to 922 kg/trip. This could be due to changes in abundance or the availability of urchins with marketable roe condition. The number of fishing trips has also declined since the 1999-00 fishing year to a low of 179 trips during the 2007-08 fishing season.

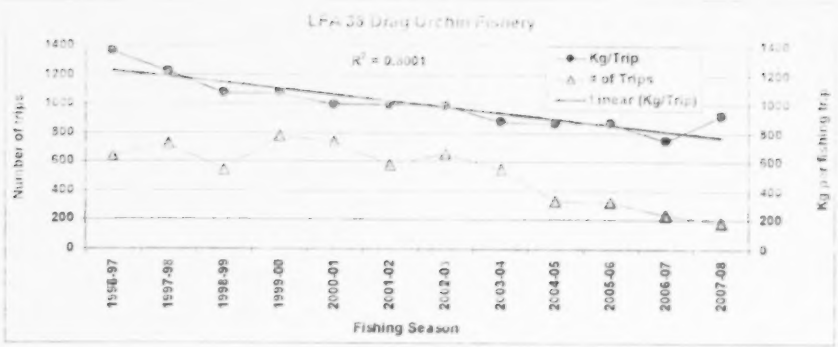


Figure 3: Seasonal landings and average catch per fishing trip for the LFA 38 drag fishery for the 1996-97 to 2007-08 fishing seasons.

RESOURCE ASSESSMENT

In LFA 38, a TAC of 979 t was established in 1996 based on biomass estimates from a diver based survey that was conducted in 1992 around the whole Island of Grand Manan. The TAC was set on an estimated total biomass of legal size urchins of 29,879 t (3.3%).

More recently, urchin surveys were initiated during the summer of 2005 and were continued during the summer of 2006 and 2007. These initiatives were made possible through Joint Project Agreements (JPA) between the Grand Manan Urchins Inc. and Fisheries and Oceans Canada (DFO).

The 2005-07 survey methods were based on similar diver transect methods used during the 1992 survey (Robinson and MacIntyre 1993, 1995). Fewer transects were sampled overall, but were located in the exact same positions as in the 1992 survey. For comparison, only data from locations resurveyed in 2005 were paired with the corresponding locations surveyed in 1992.

In summary, 46 dive transects were completed during July and August of 2005 in the traditional fishing areas that were surveyed in 1992, and an additional 14 and 21 transects were resurveyed in 2006 and 2007, respectively. During the summer of 2006 and 2007, for comparison, two transects were re-surveyed on urchin grounds where no fishing occurs, with the goal of documenting possible changes in the density of urchins that may occur independently of fishing impact. In addition, two transects were surveyed in Cheney Passage and Cow Passage, areas that have been closed to urchin dragging since 2006 in order to prevent conflict with dulse harvesting.

Diver Based Surveys (1992 Versus 2005)

Density

Based on statistical analyses of mean urchin densities, the following conclusions were reached. Within all the fishing locations combined, in both depth strata, the overall density of urchins of all sizes was not significantly different between the 1992 and 2005 survey periods (Table 2). The density of legal size urchins (≥ 51 mm TD) was significantly higher in the shallow strata (< 10 m) during both these survey periods compared to the deeper strata (10 – 20 m). The density of legal size urchins was not significantly different between survey periods.

The density of sub-legal size urchins (25 to 50 mm TD) and immature urchins (< 25 mm TD) was not significantly different between both survey periods and depth strata.

Table 2. Mean densities of urchins (urchins/m^2) of all sizes, of legal sized urchins (≥ 51 mm TD), sub-legal (25 to 50 mm TD), and immature (< 25 mm TD) sized urchins for each location during the 1992 and 2005 surveys.

1992 Survey	Total			Legals (≥ 51 mm TD)			Sub-legals (25-50 mm TD)			Immature (< 25 mm TD)		
Locations	Total	0 to10 m	11-20 m	Total	0 to10 m	11-20 m	Total	0 to10 m	11-20 m	Total	0 to10 m	11-20 m
76	11.2	11.1	11.6	5.1	6.4	0.2	5.3	4.4	8.9	0.8	0.4	2.5
77	16.2	14.3	22.5	7.9	8.9	4.4	7.3	5.2	14.3	1.0	0.2	3.7
78	10.3	17.2	4.4	2.9	6.2	0.2	7.1	10.7	4.0	0.3	0.3	0.3
79	20.4	20.4		5.9	5.9		3.6	13.6		0.2	0.8	
80	17.1	12.4	22.4	5.3	9.6	0.3	11.5	2.7	21.7	0.2	0.1	0.3
81	2.4	2.4		2.2	2.2		0.2	0.2		0.0	0.0	
82	0.2	0.2		0.2	0.2		0.0	0.0		0.0	0.0	
Total	**10.1**	**8.4**	**16.6**	**4.3**	**5.0**	**1.6**	**5.4**	**3.2**	**13.6**	**0.4**	**0.2**	**1.5**

2006 Survey	Total			Legals (≥ 51 mm TD)			Sub-legals (25-50 mm TD)			Immature (< 25 mm TD)		
Locations	Total	0 to10 m	11-20 m	Total	0 to10 m	11-20 m	Total	0 to10 m	11-20 m	Total	0 to10 m	11-20 m
76	15.5	19.2	0.7	3.1	3.9	0.0	11.0	13.7	0.3	1.4	1.6	0.4
77	21.5	23.8	13.7	7.3	9.3	1.0	12.0	12.8	9.1	2.2	1.7	3.6
78	6.8	12.0	2.4	0.6	1.2	0.0	4.1	7.5	1.1	2.2	3.3	1.2
79	40.1	40.1		1.4	1.4		30.0	30.0		8.7	8.7	
80	20.2	19.7	20.7	3.4	6.0	0.4	12.5	13.2	11.6	4.3	0.5	8.7
81	3.6	3.6		2.1	2.1		1.4	1.4		0.06	0.06	
82	0.2	0.2		0.2	0.2		0.01	0.01		0.0	0.00	
Total	**12.9**	**13.2**	**11.7**	**3.1**	**3.8**	**0.4**	**7.9**	**8.1**	**6.9**	**1.9**	**1.2**	**4.4**

Biomass

Survey coverage was more extensive in 1992 compared to 2005, with the most recent survey sampling fishery locations 76 to 82 (Table 3). Accordingly, the 1992 biomass estimates were revised so as to reflect the equivalent locations surveyed during 2005. While total biomass has changed little between the two survey periods, fishable biomass has declined by 33% from 17,131 t to 11,462 t.

The 2005 survey covered most of the fishing areas presently fished. During 2006-07 the TAC was reduced by 70% to 176.9 t. Based on the 2005 fishable biomass estimate of 11,462 t, a catch of 165 t in 2007-08 results in a harvesting rate of approximately 1.5% (less than half of the 3.3% harvest rate in 1996).

Table 3. Summary of sea urchin biomass estimates in metric tonnes (t) for each location according to the 0 to 10 m depth stratum, the 11 to 20 m depth stratum and all depths combined based on the 1992 and 2005 surveys.

	Total Biomass (t)						Legal Biomass (≥ 51 mm TD) (t)					
	1992			2005			1992			2005		
Locations	0 to 10 m	11 to 20 m	Total	0 to 10 m	11 to 20 m	Total	0 to 10 m	11 to 20 m	Total	0 to 10 m	11 to 20 m	Total
76	4,058	248	4,306	3,930	0	3,930	3,278	23	3,301	1,534	0	1,534
77	7,187	1,453	8,641	9,199	661	9,860	5,770	733	6,502	5,985	159	6,124
78	1,572	190	1,762	497	38	535	909	24	933	154	0	154
79	1,145		1,145	1,186		1,186	585		585	132		132
80	3,796	1,729	5,525	3,613	942	4,555	3,373	85	3,457	1,856	93	1,949
81	2,172		2,172	1,783		1,783	2,117		2,117	1,420		1,420
82	237		237	155		155	236		236	150		150
Total	20,164	3,621	23,785	20,369	1,647	22,016	16,267	864	17,131	11,211	252	11,462

Follow-Up Diver Based Surveys (2006 and 2007)

Density

For a subset of transects that were conducted in all survey years, although the overall density of urchins of all sizes was the highest in 2005, there was no significant difference in densities between 1992 and 2005 (Table 4). Large variability in urchin densities occurred between survey years independent of fishing activity. This variability was emphasized during 2007 when no urchin were found at a sampling site (G50) where no fishing had occurred and where large numbers of urchins were found during the previous three sampling periods (Table 4).

Table 4. Mean densities of sea urchins (urchins/m2) of all sizes, of legal sized urchins (≥ 51 mm TD), and sub-legal sized urchins (25 to 50 mm TD) for all transects combined in the fished area, for transect G23 and G50 in areas not fished, and for the closed areas during the 1992, 2005, 2006 and 2007 surveys.

	No of Section				All Size Urchin Density (#/m²)				Legal Size Urchin Density (#/m²)				Sub-Legal Size Urchin Density (#/m²)			
	1992	2005	2006	2007	1992	2005	2006	2007	1992	2005	2006	2007	1992	2005	2006	2007
Total Fished Area (2006)	154	161	160	165	9.7	17.4	11.0	6.4	6.4	4.2	1.9	2.2	3.1	12.8	8.3	3.7
*Total Fished Area	244	243		246	12.2	19.9		10.0	6.7	6.7		3.0	5.2	12.3		6.0
G50 Area Not Fished	15	15	15	15	18.9	15.9	20.7	0.0	7.7	3.2	6.6	0.0	10.8	7.7	13.5	0.0
G23 Area Not Fished	15	15		15	7.6	20.7		13.5	6.8	10.3		6.0	0.6	10.4		7.1
G103 & G104 Closed Areas			21	21			22.1	15.0			20.5	11.3			1.6	3.7

*includes additionnal transects not sampled in 2006

For the subset of transects conducted in all survey years, the density of legal sized (≥ 51 mm TD) urchins was significantly lower in 2006 (1.9 urchins/m^2) and 2007 (3.0 urchins/m^2) compared to 1992 (6.5 urchins/m^2) (Table 4). However, the density of legal sized urchins in 2005 was not significantly different from the three other sampling periods.

The density of legal sized urchins in the closed areas (G103, G104) was 5 to 10 times higher than in the fished area during 2006 and 2007. Due to the large variability, the density of legal sized urchins on transects G23 and G50 were not significantly different between survey periods, with the exception of transect G50 during 2007 where no urchins were found.

For the subset of transects conducted in all survey years, although the density of sub-legal sized urchins of all sizes was the highest in 2005, there was no significant difference in densities between survey periods (Table 4). The density of sub-legal urchins in the closed area (G103, G104) was lower than in the fished area during 2006 and 2007. Due to the large variability, the density of sub-legal sized urchins on transects G23 and G50 were not significantly different between survey periods, with the exception of transect G50 during 2007, where no urchins were found, and G23 during 1992, where very low numbers of sub-legal sized urchins were found.

Roe Quality

Sea urchin roe quality (as opposed to yield) prior to the opening of the fishery provides an indication of quality later in the year and may be important in the management of the fishery. At this time, data on roe quality from the July to September period is only available from surveys.

In order to be able to compare this data with roe quality data previously collected during the 1992 survey, only data that came from the same locations and season were used in the analysis. Data from July, August and September 1992 and 2005 were compared (Figure 4).

Based on survey data, roe quality had improved during 2005 in comparison to 1992, which is consistent with anecdotal information from the fishery and may reflect better growing conditions (i.e., food availability, water temperature, etc.). However, no data are available for the intervening years.

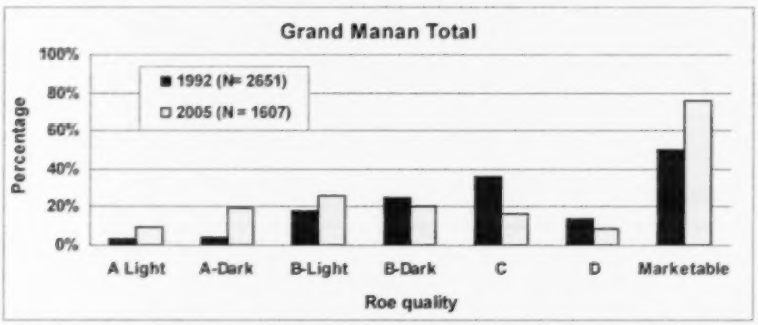


Figure 4. Roe quality by categories as a percentage of the total number of legal sized urchins tested during the 1992 and 2005 surveys. Only roe quality that falls within the categories A and B are considered marketable.

At-Sea Observer Sampling During the 2007-08 Fishing Season

During the 2007-08 urchin fishing season, at-sea observers sampled five fishing trips during the week of December 17th and 21st, 2007, and five fishing trips during the week of January 7th to 11th, 2008. (Table 5). This limited at-sea observer sampling showed the by-catch amount varied between fishing areas but was consistent in the species type present. In general, by-catch was low. Most of the by-catch consisted of a mixture of marine plants (mostly kelp) and shellfish, which was mostly composed of blue mussel, green crab, hermit crab, and a variety of shrimp. Other shellfish consisted of rock crab, Jonah crab and scallop. No lobster were caught during any of the observed trips but, according to the fishermen, the odd one is caught once in a while. A few, mostly juvenile fish, were also caught. Most of the fish captured were sculpin, winter flounder, and ocean pout (Table 5).

Based on observer reports, most of the by-catch, especially fish, is returned immediately to the water in good condition. Overall, the observer stated that the by-catch is very low compared to other drag fisheries and that the survival rate seemed to be high.

Based on observer reports, although large amounts of kelp is brought up in the urchin drags in some areas, fishermen think that the impact of the drags on the bottom is minor. Observations based on the diving surveys during the summer shows that this may be the case. In most areas surveyed, the bottom is covered with kelp and there is no evidence of dragging marks.

The relative proportion of kelp by-catch in the sea urchin trawl fishery is quite large. The kelp by-catch appears to be a combination of drift or wrack material and attached plants that are pulled off the bottom by the trawl. On a local scale, repeated trawls over the same kelp bed have the potential to reduce kelp density even if bottom 'trawl marks' are not observed. However, on a fishery wide scale, the removal of urchin biomass can lead to greatly increased kelp cover overall due to the removal of herbivore pressure, more than compensating for local kelp loss due to the footprint of the trawl gear. Resolution of this issue would require future survey work.

Table 5. Statistics on the percent of the by-catch in observed LFA 38 sea urchin fishing trips for each species during the week of December 17-21, 2007 (5 trips), and the week of January 7-11, 2008 (5 trips).

	17-21 Dec. 2007			7-11 Jan. 2008		
	Catch (Kg)	Percent of catch (with Kelp)	Percent of catch (no Kelp)	Catch (Kg)	Percent of catch (with Kelp)	Percent of catch (no Kelp)
Total Weekly Catch	**16876**	100%		**15296**	100%	
Total Weekly Catch (No Kelp)	**10772**		100%	**13134**		100%
Sea Urchins Discarded	4729	28.0%	43.9%	6772	44.3%	51.6%
Sea Urchins Kept	5071	30.0%	47.1%	5487	35.9%	41.8%
Blue Mussel	524	3.1%	4.9%	489	3.2%	3.7%
Ocean Pout	3	0.02%	0.03%	2	0.01%	0.01%
Green Crab	90	0.5%	0.8%	47	0.3%	0.4%
Hermit Crab	99	0.6%	0.9%	99	0.6%	0.8%
Hyas coarctatus	0	0.0%	0.0%	4	0.0%	0.0%
Jonah Crab	4	0.0%	0.0%	41	0.3%	0.3%
Lumpfish	1	0.0%	0.0%	1	0.0%	0.0%
Rock Crab	58	0.3%	0.5%	29	0.2%	0.2%
***Sabinea* sp.**	0	0.0%	0.0%	84	0.6%	0.6%
Sand Lance	0	0.0%	0.0%	5	0.0%	0.0%
Scallop	22	0.1%	0.2%	0	0.0%	0.0%
Sculpin	52	0.3%	0.5%	12	0.1%	0.1%
Sea Mouse	3	0.0%	0.0%	4	0.0%	0.0%
Sea Raven	8	0.0%	0.1%	0	0.0%	0.0%
Seaweed (Kelp)	6104	36.2%		2162	14.1%	
Shrimp	92	0.5%	0.9%	47	0.3%	0.4%
Winter Flounder	16	0.1%	0.1%	12	0.1%	0.1%

Urchin catch rates based on the observer information varied substantially. The weekly catch rate of legal sized urchins (≥ 51 mm TD) during December was 1,014 Kg/Trip (varied between 618 and 1,345 Kg/Trip) and in January was 1,097 Kg/Trip (varied between 526 and 2,210 Kg/Trip). This variability in the catch rate was mainly due to the area fished and the availability of marketable quality roe. Catch rates for the observed trips were approximately 1,000 Kg/Trip, which is similar to that of the overall catch rate for the fleet in 2007 (922 Kg/Trip).

The proportion of the urchin catch that was discarded was 48% (41-52%) during December and 55% (37-62%) during January.

The size distribution of urchins varied between trips, locations, and weekly periods. The proportion in weight of legal sized urchins remained relatively high during both sampling periods (84% in December and 77% in January).

Sources of Uncertainty

Only two surveys are available, are 13 years apart, and do not provide a time series to interpret biological characteristics.

No biomass survey has been conducted since 2005, so recent information is not available.

Biases in the survey design may have been introduced because survey transect locations were not re-randomized for the most recent surveys. A review of the survey design should be considered.

CPUE has elements of population abundance but is influenced by discarding due to product quality and market prices.

There is a lack of information on mortality of sea urchin due to their interaction with drags.

Survival of culled and undersized urchins from the drag fishery is unknown.

Natural mortality is unknown.

Recruitment is difficult to predict due to variability in size at age.

Roe is not sampled for quality and yield during the fishery, although the catch rates are highly influenced by this factor.

Drag impacts on the benthos have not been evaluated.

CONCLUSIONS AND ADVICE

Legal sized sea urchins show no significant differences in density between the 1992 and 2005 surveys. Total biomass has changed little between the two survey periods. While estimated fishable biomass has declined, there is no statistically significant difference between the two surveys due to a high degree of variability.

However, the survey density of legal sized (≥ 51 mm TD) urchins was significantly lower in 2006 (1.9 urchins/m^2) and 2007 (3.0 urchins/m^2) compared to 1992 (6.5 urchins/m^2)

Based on the established TAC for the 2006/07 season of 176.9 t, the recent exploitation rates are estimated to be 1.5%, which is lower than the harvesting rate of 3.3% in 1996.

Catch rates based on urchin dragger logbooks reached their lowest levels in the 2006-07 fishing season. During the 2007-08 fishing season, catch rates increased for the first time since 1996. However, CPUE is influenced by discarding due to product quality and market prices.

Implementation of the new logbook format will facilitate collection and analysis of effort and harvesting rate data by fishing area in more detail and on a timelier basis.

The recommended assessment schedule is every 5 years. However, annual monitoring of the landings, fishing effort, and catch rate from the fishing logs would be useful to determine if an earlier than scheduled assessment is required.

The diver based surveys are critical to the assessment of this resource and another survey including all fishing areas in LFA 38 is recommended in the next 2 to 3 years.

Fishery impacts on the ecosystem with respect to by-catch of non-urchin species and potential impact of urchin fishing on the habitat requires collection and processing of new information. At present there is no at-sea observer coverage, which limits quantification of by-catch amounts by the dragger fleet and the ability to evaluate ecosystem impacts of the fishery by both divers and draggers.

SOURCES OF INFORMATION

DFO. 1996. Southwestern New Brunswick Green Sea Urchins. DFO Sci. Stock Status Rep. 96/131E.

DFO. 2000. South-western New Brunswick (LFA 36-38) Green Sea Urchins. DFO Sci. Stock Status Rep. C3-49(2000).

DFO. 2008. Assessment of Green Sea Urchin in LFA 38. DFO Can. Sci. Advis. Sec. Sci. Resp. 2007/20.

Robichaud, D.A. 2010. Assessment of the Bay of Fundy Sea Urchin fishery, Lobster Fishing Area 36. DFO Can. Sci. Advis. Sec. Res. Doc. 2010/002.

Robichaud, D.A. 2010. Assessment of the Bay of Fundy Sea Urchin fishery, Lobster Fishing Area 38. DFO Can. Sci. Advis. Sec. Res. Doc. 2010/003.

Robinson, S.M.C., and A.D. MacIntyre. 1993. Sea urchin population survey of Campobello Island, Deer Island and Grand Manan. Report for the Campobello Fishermen's Association and the Canada-New Brunswick Co-operation Agreement on Fisheries and Aquaculture Development. Internal Report, N.B. Dept. Fisheries, Aquaculture, and Agriculture, Fredericton, 85 pp. (Available from: Library, Department of Fisheries and Oceans, Biological Station, St. Andrews, N.B., E2B 2L9.)

Robinson, S.M.C., and A.D. MacIntyre. 1995. Biological Fishery Information for the Rational Development of the Green Sea Urchin Fishery. Final Report for the New Brunswick Dept. Fisheries and Aquaculture and the Canada- New Brunswick Co-operation Agreement on Economic Diversification.

Robinson, S.M.C., and A.D. MacIntyre. 1997. Aging and Growth of the Green Sea Urchin. Bull. Aquacul. Assoc. Can. 91: 56-60.

Waddell, B.J., R.I. Perry, and D. Kensall. 2003. Survey Results of Sea Urchin (*Strongylocentrotus droebachiensis*) Population in Queen Charlotte Strait, British Columbia, November 1997 and March 1998. Can. Tech. Rep. Fish. Aqua. Sci. 2476.

FOR MORE INFORMATION

Contact: David Robichaud
Population Ecology Division
Department of Fisheries and Oceans
St Andrews Biological Station
531 Brandy Cove Rd.
St Andrews, N.B., E5B 2L9

Tel: (506) 529-5931
Fax: (506) 529-5862
E-Mail: Robichaudd@dfo-mpo.gc.ca

This report is available from the:

Centre for Science Advice,
Maritimes Region
Department of Fisheries and Oceans
P.O. Box 1006, Stn. B203
Dartmouth, Nova Scotia
Canada B2Y 4A2

Phone number: 902-426-7070
Fax: 902-426-5435
e-mail address: XMARMRAP@mar.dfo-mpo.gc.ca
Internet address: www.dfo-mpo.gc.ca/csas

ISSN 1919-5079 (Print)
ISSN 1919-5087 (Online)
© Her Majesty the Queen in Right of Canada, 2010

La version française est disponible à l'adresse ci-dessus.

CORRECT CITATION FOR THIS PUBLICATION

DFO. 2010. Assessment of the Bay of Fundy Sea Urchin Fishery, Lobster Fishing Area 38. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2010/002.